WHAT IS CLAIMED IS:

1. A structure for connecting a non-radiative dielectric waveguide and a metal waveguide comprising:

a non-radiative dielectric waveguide including:

parallel planar conductors arranged at a spacing of not more than half the wavelength of a high-frequency signal, and

a dielectric strip for propagating the high-frequency signal, the dielectric strip being disposed between the parallel planar conductors and provided at an end face of a terminal end of the dielectric strip with a conductive member; and

a metal waveguide having an open terminal end connected to an aperture which is formed in at least one of the parallel planar conductors at a location where an electrical field of an LSM mode stationary wave propagating along the dielectric strip becomes largest.

2. A structure for connecting a non-radiative dielectric waveguide and a metal waveguide comprising:

a non-radiative dielectric waveguide including:

parallel planar conductors arranged at a spacing of not more than half the wavelength of a high-frequency signal, and

a dielectric strip for propagating the

high-frequency signal, the dielectric strip being disposed between the parallel planar conductors and provided at an end face of a terminal end of the dielectric strip with a conductive member; and

a metal waveguide having terminal ends one of which is closed and the other of which is open,

an aperture being formed in at least one of the parallel planar conductors at a location where an electrical field of an LSM mode stationary wave propagating along the dielectric strip becomes largest,

the aperture being connected with an aperture provided in a lateral face of the metal waveguide having the closed terminal end and open terminal end, at a position of n/2 + 1/4 (wherein n is an integer of 0 or greater) times the wavelength in the waveguide from the closed terminal.

3. A structure for connecting a non-radiative dielectric waveguide and a metal waveguide comprising:

a non-radiative dielectric waveguide including:

parallel planar conductors arranged at a spacing of not more than half the wavelength of a high-frequency signal,

a dielectric strip for propagating the high-frequency signal, the dielectric strip being disposed between the parallel planar conductors, and

electromagnetic shielding members arranged along

both sides of a terminal end of the dielectric strip; and

a metal waveguide having an open terminal end connected to an aperture which is formed in at least one of the parallel planar conductors at a location where an electrical field of an LSM mode stationary wave propagating along the dielectric strip becomes largest.

4. A structure for connecting a non-radiative dielectric waveguide and a metal waveguide comprising:

a non-radiative dielectric waveguide including:

parallel planar conductors arranged at a spacing of not more than half the wavelength of a high-frequency signal,

a dielectric strip for propagating the high-frequency signal, the dielectric strip being disposed between the parallel planar conductors, and

electromagnetic shielding members arranged along both sides of a terminal end of the dielectric strip; and

a metal waveguide having terminal ends one of which is closed and the other of which is open,

an aperture being formed in at least one of the parallel planar conductors at a location where an electrical field of an LSM mode stationary wave propagating along the dielectric strip becomes largest,

the aperture being connected with an aperture provided in a lateral face of the metal waveguide having the closed terminal

end and open terminal end, at a position of n/2 + 1/4 (wherein n is an integer of 0 or greater) times the wavelength in the waveguide from the closed terminal.

5. The structure for connecting a non-radiative dielectric waveguide and a metal waveguide of claim 3, wherein electromagnetic shielding members are provided so as to enclose an end face and side faces of the terminal end of the dielectric strip.

6. The structure for connecting a non-radiative dielectric waveguide and a metal waveguide of claim 4, wherein electromagnetic shielding members are provided so as to enclose an end face and side faces of the terminal end of the dielectric strip.

7. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 1; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

8. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 2; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

9. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 3; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

10. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 4; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

11. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 5; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

12. A millimeter wave transmitting/receiving module comprising:

the connection structure of claim 6; and

an aperture antenna or flat antenna connected to the open terminal of the metal waveguide of the connection structure.

13. A millimeter wave transmitter/receiver comprising:

parallel planar conductors disposed at a spacing of not more than half the wavelength of the high-frequency signal;

a first dielectric strip for propagating a millimeter wave signal that is output from a high-frequency generation element placed at one end of the first dielectric strip;

a variable capacitance diode for outputting the millimeter wave signal as a frequency modulated transmission millimeter wave signal, by periodically controlling a bias voltage applied to electrodes of the variable capacitance diode, the variable capacitance diode being disposed such that the direction in which this bias voltage is applied coincides with the direction of an electric field of the millimeter wave signal;

a second dielectric strip, one end of the second dielectric strip being disposed near the first dielectric strip so as to be electromagnetically coupled, or being joined to the first dielectric strip;

a circulator having a first connection portion, a second connection portion, and a third connection portion arranged at predetermined spacings along a perimeter of a ferrite disk arranged in parallel to the parallel planar conductors, which connection portions serve as input/output terminals for the millimeter wave signal, the circulator outputting the millimeter wave signal inputted into one of the connection portions from another connection portion that is adjacent in clockwise or

anti-clockwise circulation within a plane of the ferrite disk, the first connection portion being connected to an output terminal of the millimeter wave signal of the first dielectric strip;

a third dielectric strip for propagating the millimeter wave signal, which is joined to the second connection portion of the circulator, and has a transmitter/receiver antenna at a front end thereof;

a fourth dielectric strip; and

a mixer portion for generating an intermediate frequency signal by mixing a portion of the millimeter wave signal and a received wave, the mixer portion being made by placing an intermediate portion of the second dielectric strip near an intermediate portion of the fourth dielectric strip to electromagnetically couple, or joining the second dielectric strip and the fourth dielectric strip together,

the second dielectric strip propagating a portion of the millimeter wave signal toward a mixer,

the fourth dielectric strip propagating a received wave that is received with the transmitter/receiver antenna, propagated along the third dielectric strip, and outputted from the third connection portion of the circulator, toward the mixer,

the first to fourth dielectric strips, the variable capacitance diode, the circulator and the mixer portion being arranged between the parallel planar conductors,

wherein a conductive member is provided at an end face

of a terminal end of the third dielectric strip, and

an aperture is formed in at least one of the parallel planar conductors at a location where the electrical field of an LSM mode stationary wave propagating along the third dielectric strip becomes largest,

the millimeter wave transmitter/receiver comprising:

a metal waveguide having an open terminal end connected to the aperture, and the other end at which the transmitter/receiver antenna is provided.

14. A millimeter wave transmitter/receiver comprising:

parallel planar conductors disposed at a spacing of not more than half the wavelength of the high-frequency signal;

a first dielectric strip for propagating a millimeter wave signal that is output from a high-frequency generation element placed at one end of the first dielectric strip;

a variable capacitance diode for outputting the millimeter wave signal as a frequency modulated transmission millimeter wave signal, by periodically controlling a bias voltage applied to electrodes of the variable capacitance diode, the variable capacitance diode being disposed such that the direction in which this bias voltage is applied coincides with the direction of an electric field of the millimeter wave signal;

a second dielectric strip having one end disposed near the first dielectric strip so as to be electromagnetically coupled,

or joined to the first dielectric strip;

a circulator having a first connection portion, a second connection portion, and a third connection portion arranged at predetermined spacings along a perimeter of a ferrite disk arranged in parallel to the parallel planar conductors, and serving as input/output terminals for the millimeter wave signal, the circulator outputting the millimeter wave signal inputted into one of the connection portions from another connection portion that is adjacent in clockwise or anti-clockwise circulation within a plane of the ferrite disk, the first connection portion being connected to an output terminal of the millimeter wave signal of the first dielectric strip;

a third dielectric strip for propagating the millimeter wave signal, which is joined to the second connection portion of the circulator, and has a transmitting antenna at a front end thereof;

a fourth dielectric strip provided with a receiving antenna at a front end thereof;

a fifth dielectric strip connected to the third connection portion of the circulator, for propagating a millimeter wave signal received and mixed with the transmitting antenna and attenuating the millimeter wave signal at a non-reflective terminal end arranged at a front end of the fifth dielectric strip; and

a mixer portion for generating an intermediate frequency

signal by mixing a portion of the millimeter wave signal and a received wave, the mixer portion being made by placing an intermediate portion of the second dielectric strip near an intermediate portion of the fourth dielectric strip to electromagnetically couple, or joining the second dielectric strip and the fourth dielectric strip together,

the second dielectric strip propagating a portion of the millimeter wave signal toward a mixer,

the mixer being provided at the other end of the fourth dielectric strip,

the first to fifth dielectric strips, the variable capacitance diode, the circulator and the mixer portion being arranged between the parallel planar conductors,

wherein a conductive member is provided at an end face of a terminal end of each of the third and fourth dielectric strips, and

an aperture is formed in at least one of the parallel planar conductors at a location where the electrical field of an LSM mode stationary wave propagating along each of the third and fourth dielectric strip becomes largest,

the millimeter wave transmitter/receiver comprising:

metal waveguides having an open terminal end connected to the aperture, and the other end at which the transmitting antenna or the receiving antenna is provided.

15. The millimeter wave transmitter/receiver of claim 14, wherein one end of the second dielectric strip is placed near the third dielectric strip for electromagnetic coupling, or one end of the second dielectric strip is joined to the third dielectric strip, so that a portion of the millimeter wave signal is propagated toward the mixer.

16. The millimeter wave transmitter/receiver of claim 13, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and a signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which the bias voltage is applied to the amplitude modulation diode.

17. The millimeter wave transmitter/receiver of claim 14, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and

a signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which the bias voltage is applied to the amplitude modulation diode.

18. The millimeter wave transmitter/receiver of claim 15, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and a signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which the bias voltage is applied to the amplitude modulation diode.

19. A millimeter wave transmitter/receiver comprising:

parallel planar conductors disposed at a spacing of not more than half the wavelength of the high-frequency signal;

a first dielectric strip for propagating a millimeter wave signal that is output from a high-frequency generation element placed at one end of the first dielectric strip;

a variable capacitance diode for outputting the millimeter

wave signal as a frequency modulated transmission millimeter wave signal, by periodically controlling a bias voltage applied to electrodes of the variable capacitance diode, the variable capacitance diode being disposed such that the direction in which this bias voltage is applied coincides with the direction of an electric field of the millimeter wave signal;

a second dielectric strip, one end of the second dielectric strip being disposed near the first dielectric strip so as to be electromagnetically coupled, or being joined to the first dielectric strip;

a circulator having a first connection portion, a second connection portion, and a third connection portion arranged at predetermined spacings along a perimeter of a ferrite disk arranged in parallel to the parallel planar conductors, which connection portions serve as input/output terminals for the millimeter wave signal, the circulator outputting the millimeter wave signal inputted into one of the connection portions from another connection portion that is adjacent in clockwise or anti-clockwise circulation within a plane of the ferrite disk, the first connection portion being connected to an output terminal of the millimeter wave signal of the first dielectric strip;

a third dielectric strip for propagating the millimeter wave signal, which is joined to the second connection portion of the circulator, and has a transmitter/receiver antenna at a front end thereof;

a fourth dielectric strip; and

a mixer portion for generating an intermediate frequency signal by mixing a portion of the millimeter wave signal and a received wave, the mixer portion being made by placing an intermediate portion of the second dielectric strip near an intermediate portion of the fourth dielectric strip to electromagnetically couple, or joining the second dielectric strip and the fourth dielectric strip together,

the second dielectric strip propagating a portion of the millimeter wave signal toward a mixer,

the fourth dielectric strip propagating a received wave that is received with the transmitter/receiver antenna, propagated along the third dielectric strip, and outputted from the third connection portion of the circulator, toward the mixer,

the first to fourth dielectric strips, the variable capacitance diode, the circulator and the mixer portion being arranged between the parallel planar conductors,

wherein electromagnetic shielding members are provided along lateral faces of a terminal end of the third dielectric strip, and

an aperture is formed in at least one of the parallel planar conductors at a location where the electrical field of an LSM mode stationary wave propagating along the third dielectric strip becomes largest,

the millimeter wave transmitter/receiver comprising:

a metal waveguide having an open terminal end connected to the aperture, and the other end at which the transmitter/receiver antenna is provided.

20. A millimeter wave transmitter/receiver comprising:

parallel planar conductors disposed at a spacing of not more than half the wavelength of the high-frequency signal;

a first dielectric strip for propagating a millimeter wave signal that is output from a high-frequency generation element placed at one end of the first dielectric strip;

a variable capacitance diode for outputting the millimeter wave signal as a frequency modulated transmission millimeter wave signal, by periodically controlling a bias voltage applied to electrodes of the variable capacitance diode, the variable capacitance diode being disposed such that the direction in which this bias voltage is applied coincides with the direction of an electric field of the millimeter wave signal;

a second dielectric strip having one end disposed near the first dielectric strip so as to be electromagnetically coupled, or joined to the first dielectric strip;

a circulator having a first connection portion, a second connection portion, and a third connection portion arranged at predetermined spacings along a perimeter of a ferrite disk arranged in parallel to the parallel planar conductors, and serving as input/output terminals for the millimeter wave signal,

the circulator outputting the millimeter wave signal inputted into one of the connection portions from another connection portion that is adjacent in clockwise or anti-clockwise circulation within a plane of the ferrite disk, the first connection portion being connected to an output terminal of the millimeter wave signal of the first dielectric strip;

a third dielectric strip for propagating the millimeter wave signal, which is joined to the second connection portion of the circulator, and has a transmitting antenna at a front end thereof;

a fourth dielectric strip provided with a receiving antenna at a front end thereof;

a fifth dielectric strip connected to the third connection portion of the circulator, for propagating a millimeter wave signal received and mixed with the transmitting antenna and attenuating the millimeter wave signal at a non-reflective terminal end arranged at a front end of the fifth dielectric strip; and

a mixer portion for generating an intermediate frequency signal by mixing a portion of the millimeter wave signal and a received wave, the mixer portion being made by placing an intermediate portion of the second dielectric strip near an intermediate portion of the fourth dielectric strip to electromagnetically couple, or joining the second dielectric strip and the fourth dielectric strip together,

the second dielectric strip propagating a portion of the millimeter wave signal toward a mixer,

the mixer being provided at the other end of the fourth dielectric strip,

the first to fifth dielectric strips, the variable capacitance diode, the circulator and the mixer portion being arranged between the parallel planar conductors,

wherein an electromagnetic shielding member is provided along lateral faces of a terminal end of each of the third and fourth dielectric strips, and

an aperture is formed in at least one of the parallel planar conductors at a location where the electrical field of an LSM mode stationary wave propagating along each of the third and fourth dielectric strip becomes largest,

the millimeter wave transmitter/receiver comprising:

metal waveguides having an open terminal end connected to the aperture, and the other end at which the transmitting antenna or the receiving antenna is provided.

21. The millimeter wave transmitter/receiver of claim 20, wherein one end of the second dielectric strip is placed near the third dielectric strip for electromagnetic coupling, or one end of the second dielectric strip is joined to the third dielectric strip, so that a portion of the millimeter wave signal is propagated toward the mixer.

22. The millimeter wave transmitter/receiver of claim 19, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and the signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which a bias voltage is applied to the amplitude modulation diode.

23. The millimeter wave transmitter/receiver of claim 20, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and the signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which a bias voltage is applied to the amplitude modulation diode.

24. The millimeter wave transmitter/receiver of claim 21, wherein an amplitude modulation diode, with which amplitude modulation of the millimeter wave signal is performed by controlling a bias voltage with an amplitude modulation signal and which outputs the millimeter wave signal as a transmission millimeter wave signal, is placed between the circulator and the signal branching portion of the first dielectric strip and the second dielectric strip, such that a direction of an electric field of the millimeter wave signal coincides with a direction in which a bias voltage is applied to the amplitude modulation diode.